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cellulare Verdauung bei Pflanzen und Tieren Vorgänge darstellen, zwischen denen kein Wesensunterschied besteht" (p. 385).

In the chapters devoted to animal forms, the nutrition of the protozoa and metazoa is considered in orderly sequence. The probable form in which nutriment is ingested is discussed, followed by a consideration of the physiological equipment of each group for the digestive disintegration of the food material and its transport within the organism. Incidentally it may be noted that the author does not accept Pütter's contention that some of the lower marine forms derive their nutriment from organic compounds dissolved in the water. Some attention is devoted to the possible significance and origin of the chlorophyll granules and so-called yellow cells (Zooxanthellen) in protozoa. References to the literature are supplied at the end of each chapter.

The first instalment of the monograph by Léon Fredericq on "Die Sekretion von Schutz- und Nutzstoffen" begins with Lieferung 4. This contains a distinctly unique compilation of the protective and defensive excretions of lower forms arranged in the sequence of the zoological system. Where possible the structural relations of the parts involved in the secretion of the fluids and substances included are described and illustrated with drawings. These chapters are certain to be very useful for reference. Among the topics included are such as the protective coverings and slimy secretions of animals, the poisons and pigments produced by them, and the relation of these to the production of pathological conditions in other animals and man. The poison in the sting of insects, the toxins of the Actinia, the acid secretion of molluscs, the melanin production of *Sepia*, the hemolysins of intestinal parasites (worms), the anticoagulant hirudin, the formation of silk, the production of waxes—are scattered illustrations of the diversity of topics included in the physiology, chemistry and toxicology of this hitherto inadequately investigated domain.

In the preface to the "Handbuch" the editor formulates the policy that in addition to a complete review of the literature there

must be an effective separation of established facts from untenable speculations and inadequate observations. In the two specimen monographs already available these aims have been followed faithfully in so far as the omission of uncertain hypotheses are concerned. If the subsequent installments of Winterstein's "Handbuch" maintain the standards here set, its place as a desirable reference work for biological investigators is assured.

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The Elements of the Science of Nutrition.

By GRAHAM LUSK. Second edition, revised and enlarged. Philadelphia and London, W. B. Saunders & Co. 1909. 8vo, 402 pp. Cloth \$3.00 net.

During recent years the American literature has been rich in dietary studies which have added much to our knowledge regarding accounts of nutrition. The publication of these studies by Atwater, Benedikt, Langworthy and others in public documents has awakened a wide-spread interest among others than students of nutrition. It is not the purpose of the reviewer to criticise adversely such publications, for their value is unquestioned, and this value lies chiefly in the attention they have attracted at the hands of readers who have not made a study of nutrition and whose reading must therefore be to a large extent superficial.

The first edition of the present book appeared in 1906. Its purpose was to treat of the fundamental principles of nutrition. The introductory chapter, which occupies 53 pages, gives a concise and well-arranged historical statement of the development and results of nutritive studies. The succeeding chapters treat of the subject under well-chosen topics. The book is of value as a reference manual to students of nutrition. It is presented in readable form, so that it is also readily available to popular readers in whom the articles referred to above have awakened a somewhat superficial interest in the subject of nutrition. It is primarily intended, however, to encourage

more careful scientific study of the question, especially in hospitals.

Laboratory methods to explain the inner processes in disease have been applied to hospital patients for twenty years or more in Germany but in the United States little has been done in this regard. If such investigations are in any way promoted by their discussion here, this writing will not have been in vain.

In the second edition the scope of the book has not been changed, but advances that have been made during the past three years are included.

W. D. BIGELOW

REPORT ON NEW ZEALAND SAND DUNES

THE New Zealand Department of Lands has recently published a paper, by Dr. L. Cockayne, entitled "Report on the Sand Dunes of New Zealand" which treats of the geology and botany of the sand dunes and their economic bearing.

The first part of the article deals, in a general way, with the damage done by dunes, the objects of dune culture or reclamation and the description and acreage of the principal dune areas.

The dune question is attacked geologically in the second part of the paper. Here are discussed the origin of dune material; dune building, and the effects of various factors on the processes of dune formation and movement; and the various land forms of the dune area.

In treating the botanical features of the New Zealand dunes, in the third part, Dr. Cockayne sets forth the ecological factors governing their flora, and describes the most characteristic plants of the region and their "adaptations." He divides the plant life of the dunes into three groups, namely, sand binders, sand collectors and wet-ground plants. The methods of spreading of dune plants are also discussed. The subject of dune-plant associations is confined to dunes of western Wellington, though the author states that these may be taken as typical of those of the central floristic province of New Zealand. It is shown that each stage in the

evolution of the dune possesses its characteristic plant association and also that "the plant-covering is an exact index of the wind force."

Among the important conclusions drawn by the author, the following may be mentioned:

It is useless to attempt artificial planting on many wandering dunes without shelter of the proper kind.

The neglect of wounds in the turf of stable dunes is perhaps the greatest source of danger to the adjacent fertile lands.

Under certain conditions a dune exposed to wind-tearing action may be naturally covered with shrubs and rendered stable without any previous preparation, except such shelter as is afforded by sand grass (*Spinifex hirsutus*).

In selecting shelter-plants for dune-afforestation purposes, tolerance of drifting sand is a matter of prime importance, without which drought or salt-resisting power are as nothing.

The paper is admirably illustrated by thirty-five excellent photographs and concludes with the citation of one hundred and thirteen works consulted in its preparation.

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SPECIAL ARTICLES

ON THE CONSERVATION OF HAILSTONES AND THE INVESTIGATION OF THEIR MICROSTRUCTURE

THE investigation of microstructure of hailstones being till now very difficult if not impossible in summer, I constructed an apparatus (Fig. 1) for their conservation till winter-time. It consists of three coaxial cylinders; the inner space is intended for hail, the middle space for a mixture of ice and cupric sulfate (approximatively in proportion corresponding to eutectics, $t = -1^{\circ}.6$), the outer space for ice, which forms a sort of guard-mantle.

During the summers 1908 and 1909 I had only once the chance of meeting a hail-storm—the 2/15 August, 1909, when I was at sea near Helsingfors on my way from Aland to St. Petersburg. This hail lasted from three to four minutes, the hailstones were very small